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Poster paper

Installation and diagnostics of a girder-system mockup for Taiwan Photon Source

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Taiwan Photon Source (TPS), a new 3 GeV synchrotron ring, is under construction at National Synchrotron Radiation Research Center (NSRRC). To discover problems of design, manufacture and installation, a mockup of 1/24 section (one cell) of TPS was installed at NSRRC. A modified, precise, six-axis, prototype girder system of this mockup composed of three girders was fabricated. We discuss both the installation of the girder system and its diagnostics, and present the results including measurement of the dimensions of the components of the girder system and the vibration tests.

1. Introduction

Taiwan Photon Source (TPS), a new 3 GeV synchrotron ring, is under construction at National Synchrotron Radiation Research Center (NSRRC). To discover problems of design, manufacturing and installation, a mockup of 1/24 section (one cell) was installed. The girder system of the mockup composed of three girders was fabricated as shown in figure 1. The prototype of the modified, precise, six-axis, girder system is designed to support magnets and the vacuum system (Tseng *et al.*, 2008). Here we present the installation and diagnostics of this girder system. These diagnostics concern two aspects – the dimensional measurement of the components of the girder system and their vibrations.

2. Installation of the girder system

The beam direction was first set with control points that serve also to monitor the fiducial points on the girder system. After setting the centre line of each pedestal, the screws to support the pedestal were glued onto the ground with a template as in figure 2.

The positions of the nine pedestals were aligned within 0.2 mm with a laser tracker. To increase the stability of the girder, pedestals were grouted with unshrinking concrete.

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FIGURE 1. A mockup of 1/24 section for TPS.

FIGURE 2. The pedestal supported by screws is aligned and grouted.

The eccentric cam movers that adjust the position of the girder were assembled and installed on the pedestals. The main girder bodies assembled with ball unit housings were then installed on the cam movers (figure 1).

3. Measurement of dimensions of the components of the girder system

The dimensions of each component of the girder system influence the precision and convenience of its assembly. All components were therefore inspected before installation.

The bottom bodies and top plates of the pedestals were inspected with a portable and bridge-type Coordinate Measuring Machine (CMM) as in figure 3. The results showed that the holes on the pedestal were within the tolerance according to the engineering drawing.

Both the cylindrical outer diameter and the spherical diameter of the ball unit were inspected with a portable CMM. The height of the ball units was examined with an altimeter. The hardness (HRC) and loading test (12 tons) of the ball unit were also certified by a Taiwan Accreditation Foundation (TAF) laboratory

FIGURE 3. The main body and top plate of the pedestal were inspected with a CMM.

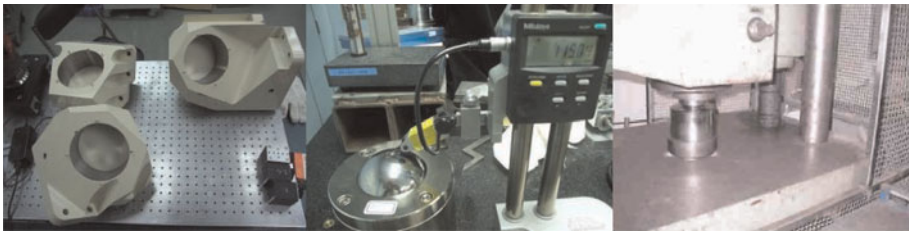

FIGURE 4. Inspecting the ball unit and housing.

(figure 4). After inspection showed several ball units to be beyond specification, they were all returned to the manufacturer and replaced with new ones.

The dimensions of the components of the eccentric cam movers, as in figure 5, were measured also with a portable CMM and an electric micrometer. As the channel on the bottom of the housing was fabricated too narrowly to fit the key, the housing was replaced and thus improved.

4. Measurement of vibration of the girder with magnets

Tests of vibration of the modified TPS prototype girder without magnets were performed previously (Hsu *et al.* 2009), but magnets were installed on girder 1 (G1) for further vibration tests (figure 1). The wedge modules used to clamp the girder were also placed between the pedestal and G1. The results of the first natural frequency of G1 with magnets and six wedge modules compared with those of G1 without magnets are listed in table 1. The first natural frequencies of G1 with

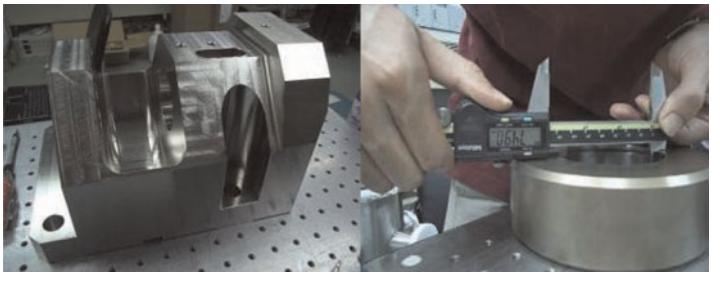

FIGURE 5. Inspecting the housing and cam of the eccentric cam-mover assembly.

	First natural frequency		
G1 direction	No magnet (Hz)	With magnet (Hz)	With magnet + six wedges (Hz)
X (transverse)	24.90	12.09	17.94
Y (vertical)	40.65	19.41	35.89
Z (Beam)	26.73	19.41	30.03

TABLE 1. The first natural frequency of G1 with magnets and six wedges.

magnets obviously increased after the locking system was applied in three directions.

5. Conclusions

The installation and diagnostics of the girder system were undertaken, which will facilitate the future construction of the entire TPS ring.

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